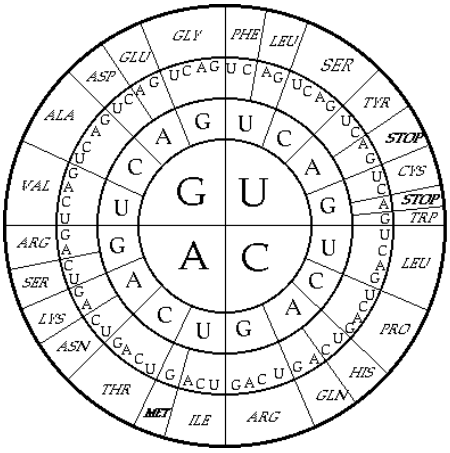
Questions for the lecture "Basic concepts in Human Variation"

Each question is multiple choice with four possible answers, only one of which is correct.

1. A mutation has been found in a biopsy from a patient with breast cancer. The same mutation has not been found in the blood of the same patient.
a) This is a germline mutation. If it fixates in the population (>1%), it is called SNP.
b) This is the germline mutation responsible for the patient's cancer.
c) This is the somatic mutation responsible for the patient's cancer.
d) This is a somatic mutation. Without further analysis we can not asses its implication in the development of the tumor.

2. A mutation has been found in the BRCA1 gene of a woman. Her father is also carrier of the same mutation.
a) This is a germline mutation, consequently never implicated in disease.
b) This is a somatic mutation implicated in breast cancer.
c) This is a germline mutation. We will probably find this mutation in all her cells.
d) This is a somatic mutation. We will find this mutation in all the cells of her body.

3. An individual has a G->C mutation in a AGC codon.
a) It is a Serine to Threonine non-synonymous mutation.
b) It is a synonymous mutation. Both codons encode Serine.
c) It is a Serine to Proline non-synonymous mutation.
d) It is a synonymous mutation. Both codons encode Proline.



4. A mutation to C in the 3rd position of a GGG codon.
a) Is a synonymous mutation. Both codons encode Glycine.
b) Is a synonymous mutation. Both codons encode Arginine.
c) Is a non-synonymous mutation from Glycine to Arginie.
d) It is a non-synonymous mutation. The codon changes from GGG to GGC.

5. In a conserved residue that needs to be phosphorylated for the enzyme to function...
a) A synonymous mutation would be extremely relevant for the function of the protein.
b) A non-synonymous mutation is not relevant. Another residue in the surrounding area would be phosphorylated and the function of the enzyme will prevail.
c) A non-synonymous mutation might affect the activity of the enzyme.
d) A somatic mutation will never be observed.

Answers and explanations.

1. D. The mutation is not present in all the cells of the patient. This indicates that it is a somatic mutation. Only a small fraction of the mutations that we observe in a tumor sample have a functional role in the development of the disease and further analysis is required.
2. C. The mutation is present in both her and her dad. This hints that it is a germline mutation that she inherited from him. All the cells in her body will carry the same mutation.
3. A. Reading from the inner circle of the genetic code chart, ACG encodes for Ser whereas ACC encodes for Thr. Since the resulting amino acid is different, this is a non-synonymous mutation.
4. A. Reading from the inner circle of the genetic code chart, both GGG and GGC encode for the same amino acid, Glycine (Gly) in this case. It is consequently a synonymous mutation.
5. C. The fact that the residue is conserved through evolution hints that it is relevant for the function of the protein. A non-synonymous mutation would cause this amino acid to change, disrupting the normal functioning of the protein. This is particularly relevant in the case of phosphorylation since only a subset of amino acids (Ser, Thr, Tyr) can accept a phosphate group.

Feel free to send further questions to Jose MG Izarzugaza (txema@cbs.dtu.dk)